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ENTERPRISE INVESTMENT AND PUBLIC CONSUMPTION IN A SELF-MANAGED ECONOMY

by

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ABSTRACT

The paper describes a differential game model of a self-managed economy. Workers in self-managed firms control the distribution of post-tax enterprise earnings between personal consumption and enterprise investment. State agents organize public consumption of collective goods (health, education etc.) and provide for pensioners and the unemployed, financing their activities through taxation of enterprise income. Noncooperative and cooperative solutions to the game are analysed and compared and the model is applied to the case of various institutional arrangements adopted in the self-managed economy of Yugoslavia in the post-war period.

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Enterprise Investment and Public Consumption in a Self-Managed Economy

1. Introduction

The post-1974 institutional framework in Yugoslavia has been characterised as a mechanism to supplement the operation of the market by a network of bargaining procedures between firms, associations of firms, and the state. As Comisso (1980) has put it: "if the state . . . is now a legitimate player in the economic game, industry is to be its partner". In so far as self-management relations of production internalize the conflict between labour and capital over the distribution of the product between current personal consumption and accumulation, they do so, of themselves, only at the expense of emphasising the conflict between the worker-collectives' control over personal consumption and accumulation decisions on the one hand, and state control over public consumption on behalf of those excluded from access to the socialized means of production, on the other. The institution of self-management planning developed in Yugoslavia since 1974 can be seen as a mechanism designed to effectively internalize this fundamental conflict characterizing a self-managed economy. Comisso's telling phraseology suggests that this phenomenon can usefully be modelled through the application of a game theory approach. In this paper we therefore analyze the evolution of macroeconomic aggregates in Yugoslavia as a dynamic differential game between workers and the state.[1] This approach has already been successfully applied to the wage/accumulation conflict of capitalism by Lancaster (1973), Hoel (1978) and Pohjola (1983a,1985b). It has also been applied to the case of a capitalist economy with workers' investment funds (Pohjola, 1983b), and the present extension to the case of a self-managed economy suggests that useful across-system comparisons may be available in the future. However in the present paper such a comparative analysis is not attempted, and the analysis is limited to the analysis of differing games played in a self-managed economy.

2. The distribution of the surplus product in Yugoslavia

In a self-managed economy control over the economic decisions taken by enterprises resides in principle with the entire workforce. Of course, day-to-day management is performed by a specialized management staff, but the overall policy on investment, hiring and firing, product line and quality, capacity utilization, pricing and working conditions lies with the work-community. Enterprises operate in a market environment in the sense that they are free to buy and sell commodities at a known value. Goods markets are thus fairly conventional, and in Yugoslavia, for example, one does not observe long queues for commodities as is typical of centrally planned economies. On the other hand the markets for productive factors, labour and capital are only quasi-markets. There is no set price for labour, which receives "residual income" depending upon the enterprise's market performance, and, since capital is "socially owned", there are restrictions over enterprises' ability to manage capital inputs. In Yugoslavia, for example, enterprises must maintain in value terms existing capital--there must be no net disinvestment. This is all very well for enterprises which produce goods for which there is a readily available market. But for classic public goods (which may be consumed at zero marginal cost) or other goods which may be designated collective goods, such as health, education, and other social services, there may be practical or social obstacles to market provision. Practical problems occur in the provision of roads, for example, where metering may be prohibitively costly, given the near zero marginal cost of consumption. Social obstacles occur in the provision of education or health services. Since these services enter into the formation of human capital, a certain equality of distribution is required whenever the reduction in inequality of initial endowments is felt to be important. As Horvat (1976) points out, "the rule of distribution according to labour (i.e. socialist exchange) can be applied only in situations in which the basic requirement of equality of opportunity is not jeopardized" (p. 122). The public sector therefore operates according to the principle of "distribution according to needs". This must also be the case for those among the population who are excluded access from socially owned capital, i.e. the unemployed and pensioners. All of this implies a continuing role for the state in a self-managed economy as some non-market forms of financing and distribution of public consumption must be arranged. It is not surprising therefore that in the evolution of the self-management economy in Yugoslavia a large part of the story has been played out by changing relations between the enterprises and the state. In particular, the changing nature of the control over and distribution of the surplus above material costs has been a central focus of the various economic reforms which have been undertaken in the post-war period.

Initially the self-management system was little more than an arrangement whereby workers were granted limited rights of participation in exchange for the acceptance of tight controls over the level of real wages (Bartlett, 1980). The enterprise director was a state appointee, investment decisions were taken centrally through the investment planning system which remained in force until 1957, and labour payments were made on the basis of a fixed wage with a variable profit sharing supplement. That part of profits not "shared" with the workers was appropriated by the state budget. However, in 1957, at the first Congress of Workers Councils, demands for greater freedom in enterprise income distribution were heard. As Lydall (1984) notes, "workers and managers in prosperous enterprises were getting tired of surrendering so much of the income of their enterprises to the government". In 1958, therefore, in a mini-reform, the principle of distribution was changed from profit-sharing to income sharing, by which no fixed wage payment was made, and the distinction between fixed and variable wages was abolished. The enterprises were, in principle, free to distribute net post-tax income between personal incomes and enterprise funds. The profits tax was replaced by a 15% tax on net income ("dohodak").

However, at this stage, only the "micro-level" aspects of self-management were in full operation, that is to say the enterprise could be characterised as one whose objective would be to maximize income per employee. (And in fact it was just at this point that the original income-per-head maximizing model by Ward appeared in the American Economic Review.) The enterprise still did not have full control over investment decisions, which were influenced also by the various agencies which were responsible for formulating the "Social Plan" and distributing investment funds (the General Investment Fund at the federal level and the Social Investment Funds at the republican level). Changes in the distribution of the investment funds among the various agencies depended largely on changes in the tax laws, since the Funds were financed by taxation. This distribution fluctuated as follows.

Table 1. Investment in Fixed Assets by Source of Funds (%)

	1952	1955	1960	1962	1964
State	98	64	62	59	36
Enterprises	2	35	37	38	32
Banks	-	1	1	3	32

Source: World Bank (1975).

According to the OECD report of 1962, "in view of the Yugoslav authorities, the policy of centralization of part of the incomes of enterprises and workers in social funds helps to redistribute and channel the use of available national resources in a socially desirable manner" (p. 22). In general enterprises could find themselves in a position of being unable to complete their own plans if these were in conflict with the federal plan and the plans of other "socio-political communities" (i.e. republican and local government authorities). In enterprises where the federal plan was not being fulfilled, the federal planning authorities could overrule the enterprise plan. Even in normal circumstances the federal "social planning" agencies had powers to instruct enterprises and industries in aspects of capital formation and utilization.[3] So in general throughout this period the limits of decentralization of control over investment policy and the distribution of surplus product were closely circumscribed. This enabled the proportions in which investment resources were distributed between the various sectors of economic activity to be closely regulated by the plan.

But reform was in the air. In 1964 the 5th Congress of the Federation of Trade Unions "gave support to greater income retention by enterprises and greater enterprise control over investment policy" (Lydall, 1984, p. 81). In 1963 the General Investment Fund was abandoned and its resources handed over to specialized investment banks and the dismantling of the Social Investment Funds of the republics in 1964 called an end to the system of investment planning. The full complement of reforms carried out in 1965 ensured that enterprises themselves had full freedom to make decisions over the allocation of their own investment funds. The allocation of net income between the "Business Fund" (i.e. accumulation)and the "Personal Income Fund" (out of which wages were paid) was put fully at the discretion of the enterprise and its workers council. The director of the enterprise was now elected by the workers council, and all rules and regulations imposed from outside the enterprise which had existed previously were rescinded. A flat 25-30% tax was imposed on the personal incomes fund and was levied by the commune. A capital tax was retained (to be abolished in 1970) and the multiple tier turnover tax was replaced by a single tier sales tax. All other taxes on the enterprises were abolished (Hanžeković, 1973). The object was to leave a greater proportion of net income at the disposal of the enterprise, with a smaller part taken by taxes. Thus the 1965 reforms are often taken to have introduced a period of maximal self-management, in which the enterprises themselves had unconstrained freedom to make decisions regarding the rate of investment in addition to setting prices, wage levels and levels of employment. At this stage both the "micro" and "macro" aspects of self-management were operational.

However, the public sector was left out of this progression towards decentralized self-management. Health, education and social welfare provision were still financed directly out of the state budget. In order to extend self-management relations into this sector a further round of reforms was carried out in the mid 1970's. The object of these reforms was to integrate the provision of social service (collective consumption) into the economic decision-making framework of the self-managing enterprises.[4] The formal framework was set out in the new Constitution of 1974. The new system was based upon the formation of self-managed communities of interest (samoupravne interesne zajednice - SIZovi) which would act as a link between enterprises who financed the services and the service organizations themselves, and were a type of bargaining instrument to determine the allocation of resources to public consumption. In the SIZovi, delegates from the enterprises in a locality and from the local social service organizations would determine the tax rates (contributions) to be levied, and the level of service to be provided, in principle quite independently of state control.[5] Contributions ("doprinosi") fall typically on personal incomes.[6] Pejovich (1979) reports an average contribution rate to the health sector of 8-9%. In this way the SIZovi channel some 60% of public consumption, i.e. the so-called "collective needs" (zajedničke potrebe) for education, health, child welfare, social welfare, etc. The other 40% of expenditure is accounted for by state agencies, for "general social needs" (opštedruštvene potrebe), i.e. for the finance of the budgets of the "socio-political communities". This covers the expenses of state agencies and institutions, defense expenditure, and the fund for regional development, and is financed directly by taxation ("porez"). The significance of the new system of social planning of public consumption, which is referred to as the "free exchange of labour" (i.e. the exchange of finance from "productive" enterprises for services from "non-productive" enterprises) is the joint bargaining element which is introduced into the determination of the allocation of the enterprise surplus between wage payments, enterprise investment allocations, and contributions for public consumption. In this bargaining situation productive enterprises and the suppliers of social services can, together, come to an agreement about the current distribution of social resources between current private consumption, current public consumption, and current investment which will increase resources for future distribution. This "cooperative game" approach to the distribution of the national product characterises the system of self-management which the Yugoslavs attempted to devélop in the post-1974 period.[7] At least, this is the principle. In practice things may be rather different. Typically contribution rates are uniform across SIZovi, which suggests the continued influence of the state in the finance and organization of collective consumption. Šefer observes that "in relation to such an overall concept of the role of /public/ consumption in economic development and the forms of financing it, practice to date has been seriously lagging. . . Financial relations between the economy and the social services, although institutionally organized on a self-management basis (through self-management communities of interest) continue to be characterised by fiscal sources of financing social consumption, and less so through the free exchange of labour" (p. 272).

Clearly, the mere formal institutional framework does not always tell us a great deal about the reality of allocation and distribution mechanisms operating in any actual economy, and Šefer may well be right in his observations on the divergence of practice from theory. In order to get a grip on the likely effects of the operation (or non-operation) of the formal institutional framework a model is developed in the following section which describes the distribution process between private consumption, public consumption and enterprise investment as a differential game between the workers and the state. The model is derivative of the work of Lancaster (1973), Hoel (1978) and Pohjola (1983a) who analyse capitalism as a game between workers and capitalists and Pohjola (1983b) who analyses a capitalist economy with workers' investment funds. Both noncooperative (Cournot-Nash) behaviour (characterising the formal institutional framework of the post-1965 period) and cooperative (joint decision) behaviour of the post-1974 "free exchange of labour" period are analysed.

3. A differential game model of a self-managed economy

In this section we model a stylized self-managed economy which contains two separate groups of decision makers, workers and state agents. Workers, organized in self-managed firms, make decisions over the distribution of the net product between personal consumption and investment and on employment levels; state agents make decisions on tax rates and hence upon the current level of provision of public consumption.

The game-theoretic element is the following. Given current tax rates, the workers may decide to undertake some savings (and corresponding investment) by reducing current consumption, in order to provide for a higher level of future consumption. But they have no guarantee that the state will not appropriate the future proceeds of their current sacrifice by raising tax rates in the future. On the other hand, the state may tax enterprises heavily to increase current public consumption, but if they do so, it diminishes the resources available for investment which would augment the future tax base. However, should the state decide to tax relatively lightly in the current period, it has no guarantee that the workers actually will undertake the level of investment it would wish. If it follows this strategy it may only be to see its worst fears fulfilled, that the workers will consume the surplus. The associated noncooperative game equilibrium strategies of workers and state are developed in this section. Later on we consider the cooperative strategies which characterise the use of negotiation, social compacts and free exchange of labour under self-management planning. A key difference between the present model and those of the capitalist economy is that here decisions over saving and investment are undertaken by the same group of agents, the workers.[8] Problems arise in the self-managed economy on the contrary because of the separation of decisions over private and public consumption.

Self-managed firms use inputs of capital (K) and labour (L) to produce output according to the production function F(K,L). Output per worker is $y = F(K,L)/L$. Enterprises are assumed to maximize net consumption per head over a horizon T, by choice of savings rate s, given[9] the level of employment L, a sales tax rate z_1, (porez), and an income tax rate z_2 (doprinosi); i.e. to maximize the functional:

$$\max_{s} J_1 = \int_0^T (1-z_1)(1-z_2)(1-s)y\,dt$$

subject to a capital accumulation constraint

$$\dot{K} = (1-z_1)syL$$

Without loss of generality we can assume employment growth to be zero i.e.

$$\dot{L} = L_0 e^{nt} \text{ where } n = 0.$$

In addition, initial conditions are given by

$$K(0) = K_0$$

and the control region is given by

$$0 \leqslant s \leqslant s(z_i), \ s' < 0, \ i = 1,2.$$

The maximum rate of savings is given by the minimum level of consumption per head. Clearly, the higher the rate of taxation, the lower the maximum rate of savings compatible with a given minimum level of consumption per head. The associated Hamiltonian function is given by:

$$H_1 = (1-z_1)(1-z_2)(1-s)y + \psi_1(1-z_1)syL$$

where ψ, is the adjoint variable representing the current valuation of investment, by worker-managers, in terms of consumption.

Correspondingly, the state is assumed to maximize the collective consumption of entire population including the un-employed, pensioners, and other non-participants in the production process, by varying the tax rates; i.e. to maximize the functional:

$$\max_{z_i} J_2 = \int_0^T [z_1 y + z_2(1-z_1)(1-s)y] \ (L/N)dt$$

where N is the size of the population, which again, without loss of generality, is taken to be fixed. Public consumption is also subject to the capital accumulation constraint

$$\dot{K} = (1-z_1)\,syL$$

and is bound by the initial condition

$$K(0) = K_0$$

and the control regions

$$0 \leqslant z_1 \leqslant a$$
$$0 \leqslant z_2 \leqslant b.$$

We assume there are upper bounds, a and b, to the politicaly feasible tax rates, each strictly less than 1/2, which are determined by historical and cultural factors, independently of the game process, and which, if they do change, change only very slowly. Note that it is only the enterprises which undertake investment. The Halmiltonian relevant to the state's problem is:

$$H_2 = [z_1+z_2(1-z_1)(1-s)]\,y\frac{L}{N} + \psi_2(1-z_1)\,syL$$

where ψ_2 is the adjoint variable representing the current valuation, by the state, of investment in terms of consumption.

Each player chooses his strategy on $\{s\}$ or $\{z_1,z_2\}$ so as to maximize the relevant Hamiltonian subject to the capital accumulation constraint on K. Only open-loop strategies are considered so that no use is made of additional information which becomes available over the time horizon. We begin by solving the non-cooperative version of this non-zero sum differential game.[10]

Necessary conditions to solve the game are:

$$\frac{\partial \psi_i}{\partial t} = -\frac{\partial H_i}{\partial K} \; ; \; \psi_i(T) = 0$$

and H_i is maximized by choice of the relevant control variable.

Clearly $\dot{\psi}_1 < 0$, $\dot{\psi}_2 < 0$ for $F_K > 0$. Thus, so long as the marginal product of capital is not driven below zero, the shadow price of investment will be falling over the time horizon.[11] Moreover,

$$\partial H_1/\partial s = (1-z_1)y[\psi_1 L-(1-z_2)] \gtrless 0$$

as $\psi_1 \gtrless \dfrac{(1-z_2)}{L}$.

In addition

$$\partial H_2/\partial z_1 = yL[\frac{1-z_2(1-s)}{N} - \psi_2 s] \gtrless 0$$

as $\psi_2 \lessgtr \dfrac{(1-z_2) + z_2 s}{sN}$

and $\partial H_2/\partial z_2 = (1-z_1)(1-s)y\frac{L}{N} > 0$

Clearly $\psi_2^c > \psi_1^c$ where ψ_i^c is the critical switching value of the shadow price of investment for the respective player.[12] The open-loop Nash solution is therefore as follows:

$$s = \bar{s}\ (0,b),\ z_1 = 0,\ z_2 = b \text{ for } t \in [0,t')$$
$$s = \bar{s}\ (a,b),\ z_1 = a,\ z_2 = b \text{ for } t \in (t',t")$$
$$s = 0\ ,\ z_1 = a,\ z_2 = b \text{ for } t \in (t",T].$$

Thus there are three distinct phases. The workers initially save and invest at the maximum rate while the state initially refrains from imposing a sales tax. In the middle phase, the state imposes sales taxation, but the enterprises continue to save and invest since the shadow price of investment, in terms of their own consumption is still above its critical value. However, the rate of savings falls in compensation for the reduction in net revenue. In the final phase, enterprise savings and investment falls to zero and private and public consumption take place at the maximum rates. The state imposes income taxation throughout.

The cooperative solution can be found by taking a weighted average of the two functionals. The self-management planning mechanism, as a device for ensuring cooperative play, thus involves maximizing the joint functional:

$$\max_{s,z_1,z_2} J_3 = \int_0^T \{\lambda_1 (1-z_1)(1-z_2)(1-s)y + \lambda_2 [z_1 + z_2(1-z_1)(1-s)]y \frac{L}{N}\} dt$$

where λ_1, λ_2 are bargaining weights with $\lambda_1 + \lambda_2 = 1$.[13]

The associated Hamiltonian is:

$$H_3 = \{\cdot\} + \psi_3 (1-z_1) syL$$

and the switch point is found by differentiation with respect to s:

$$\frac{\partial H_3}{\partial s} = \psi_3 (1-z_1) yL - \lambda_1 (1-z_1)(1-z_2) y - \lambda_2 z_2 (1-z_1) y \frac{L}{N} \gtrless 0$$

so that the switch point for s is given by:

$$\psi_3 \gtrless \frac{\lambda_1(1-z_2) + \lambda_2 z_2 (L/N)}{L}$$

Comparing the cooperative and non cooperative solution gives

$$\psi_3^c \gtrless \psi_1^c$$

as $\quad z_2 \gtrless \frac{N}{N + L}$.

Since

$$1 \geqslant [\frac{N}{N + L}] \geqslant 1/2$$

and

$$z_2 < 1/2$$

it follows that the critical value of ψ relevant to savings decisions in the cooperative game is lower than that in the non-cooperative game. Consequently we may expect the final reduction in savings and investment to be delayed in the former case.

The conclusion of the analysis, therefore, is that we expect positive saving to continue for longer under conditions of joint decision making over the distribution of the surplus product. The intuitive reason is that under joint decision-making arrangements, enterprises take into account not only their own consumption profiles but also the profile of public consumption, over the planning horizon. In the non-cooperative game, the shadow value of investment falls to its critical value, before it falls to the critical level as valued by the society as a whole. Thus although it would be socially optimal for enterprises to continue to invest, under non-cooperative arrangements, where they only consider their own interest, they will not do so.

This suggests a possible hypothesis for the behaviour of distribution in Yugoslavia, namely that if the rules of the game were genuinely changed from a non-cooperative to cooperative scheme following the institution of self-management planning in 1974, we would expect a rise in investment relative to public consumption in the years immediately following the change, to reflect the greater willingness of enterprises to undertake investment in the face of positive rates of taxation.

This would be followed by a subsequent fall in investment when the (extended) switching value of ψ_3 was reached.

4. Empirical Evidence

Yugoslav statistical data are calculated according to the MPS (material product system). Unlike the United Nations SNA (system of national accounts) methodology, no direct account of "non-material" or "unproductive" activities is included in the calculation of Social Product. However, separate accounts of the unproductive sector are produced, and both the OECD and a study by Krejči (1982) have shown how figures for GDP at market prices may be extracted from the Yugoslav statistics. A series approximating the notion of "government final consumption expenditure" can also be constructed, which reflects the actual end use of resources in the social service sector. It is constructed by adding together a series for wages and salaries paid to workers in the sphere of collective consumption, general social consumption, and banks and insurance companies and a series for intermediate consumption of goods and services by these organizations (OECD, 1983). The following table compares the resulting series with one for GDP at market prices, government final consumption expenditure of the EEC, and gross fixed capital formation for 1967-1981.

Table 2. Aggregates as a % of GDP at market prices

(1) Year	(2) Govt. final Consumption Expenditure Yugoslavia	(3) EEC	(4) Gross Fixed Capital Formation	(5) 2 ÷ 4	(6) Consumers Expenditure
1967	17.0	15.4	25.6	66.4	53.5
1968	17.7	15.2	27.0	65.5	53.3
1969	17.0	15.1	26.9	63.2	52.3
1970	16.8	15.2	28.4	59.2	52.5
1971	15.6	16.0	27.5	56.7	51.7
1972	16.0	16.2	26.2	61.1	53.6
1973	14.9	16.2	24.1	61.8	52.9
1974	15.7	17.2	24.8	63.3	51.6
1975	17.0	18.2	28.3	60.1	51.1
1976	17.4	17.9	30.2	57.6	51.5
1977	17.7	17.8	32.1	55.1	51.4
1978	17.4	17.9	35.1	49.6	51.9
1979	17.6	18.0	34.6	51.0	51.9
1980	16.9	18.6	31.7	53.3	51.1
1981	15.8	19.3	28.4	55.6	50.9

Sources: OECD "Economic Survey of Yugoslavia", June 1983, Table B; May 1980, Table B; OECD "Economic Outlook" 1984.

Private consumption was a rather stable proportion of GDP over the period, falling slightly from 53.5% in 1967 to 50.9% in 1981, but never departing from that range. On the contrary, large swings are observed in the series for the share of gross fixed capital formation, which rose from 24.1% in 1973 to 35.1% in 1978. Public expenditure also rose slightly between these years, but never rose more than 3 percentage points above its 1973 levels. It is remarkable that although slightly less stable, the share of "government final expenditure" in GDP in Yugoslavia was broadly similar to that in the EEC countries. The impact of 30 years of supposed "de-etatisation" does not seem to have had a great effect upon the allocation of the share of resources to final public consumption.

Despite the slight rise in the share of this aggregate between 1973 and 1978, the overall ratio between government final consumption and gross fixed capital formation, reported in column 5, declined sharply from an index of 61.8 to one of 49.6. This could clearly be interpreted to support an argument that the new system of self-management planning did indeed have the effect of bringing together the two opposing interests of private and public consumption in a joint decision-making framework, and was not merely a smokescreen for the continuation of the bad old alienated ways of the previous constitution as suggested by Šefer. However, if this was indeed the case, then it must also be noted that the system was supported by running a continuous balance of payments deficit over the period, of increasing both public and private consumption, rather than of making realistic trade-offs between the two, and storing up problems for the future. Indeed by 1980 the Yugoslav economy was plunged into a serious economic crisis as its external debts mounted to insupportable levels. Average annual growth of GDP of 6.1% between 1973 and 1978, well in excess of that for the EEC countries (Germany 2.4%, Italy 3.2%) was made possible by the investment boom. However, real gross social product rose by only 2.2% in 1980, 1.4% in 1981, 0.7% in 1982 and fell by 1.3% in 1983 (Economist Intelligence Unit, 1984, 4). A stabilization programme agreed with the IMF in the early 1980's resulted in aggressive devaluation of the dinar, price inflation approaching 60% in 1984, and falls in the level of consumer expenditure (1% in 1981, 0.1% in 1982 and 0.1% in 1983), public consumption (0.7% in 1981, 1.6% in 1982 and 1.5% in 1983) and enterprise investment (9.3% in 1981, 5.5% in 1982 and 5.5% in 1983). Real wages are reported to have fallen by some 25% between 1979 and 1983 and by a further 10% in 1984 (Economist Intelligence Unit, 1984, 4).

5. Conclusion

The Yugoslav experience in the post-1974 period can be interpreted in differing ways. Rising investment shares in an initial stage (as the game framework switches from a noncooperative regime to a cooperative regime) followed by falling investment shares (as the switching value of ψ is reached) are predicted by the model. Such a strategy may be considered Pareto optimal if it reflects a socially agreed choice to postpone an immediate increase of current consumption for the sake of higher future levels of both private and public consumption. However, if the economy's external budget constraint is not respected and a social choice is made for higher shares of both investment and consumption simultaneously, then it may be thought that the design of the bargaining mechanism contains inherent defects. More favourably, Yugoslavia's current crisis could be viewed as a representative example of the difficulties experienced by a number of small outward-oriented newly-industrializing countries of the European periphery (Greece, Spain, Portugal) faced by a dramatic deterioration in their external market fortunes.

Notes

1. For a useful survey of the application of this branch of game theory to economic problems see Clemhout and Wan (1979).

2. For a more extensive treatment of arguments for collective provision of public goods see Atkinson and Stiglitz (1980).

3. In addition to implementing the general distribution of investment resources in conformity with the social plans on a republic and sectoral level, the banks which implemented the funds also took various financial indicators into account when allocating funds between projects. The types of criteria applied on a project level included the share of capital which the enterprise itself was prepared to contribute to the project, the balance of payments effect, and the "contribution to output" which the project would make, a type of capital-output criteria.

4. "If social services were financed and organized through the state, a growing proportion of workers' income would be alienated, the social service workers would be mere employees", Šefer (1982), p. 266-7.

5. For a more detailed account of these arrangements see Bartlett (1985).

6. Some 70% of contributions are levied on personal incomes whilst only 30% are levied on "enterprise income" (i.e. prior to the distribution of income to the business and personal income funds); Jurković (1982).

7. ". . . the socio-political significance of free exchange of labour is its ability to create conditions in which workers (both in the sphere of material production and in social services) can jointly determine the conditions in which they work and dispose of the results of their labour"; Jurkovic (1982), p. 220. Emphasis added.

8. ". . . the welfare loss from capitalism is due to the game-type situation which arises from the separation of the consumption decision from the investment decision. In this sense, the weakness of capitalism is of a Keynesian, rather than a Marxian, kind"; Lancaster (1973), p. 1106.

9. It is assumed that employment is chosen exogenously to the enterprise in Yugoslavia, e.g. by the self-management planning agreements with the local and republican state organs.

10. See Clembout and Wan (1979) or Ho and Olsder (1983).

11. It is assumed that capital is sufficiently productive that this condition holds.

12. In fact the bang-bang nature of the solution would be smoothed if the Hamiltonians were non-linear in the controls. This would occur if the objective functionals were set up in utility terms.

13. A standard theorem in game theory ensures that this will provide a Pareto optimal set of strategies;

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